



Living Materials Care and Handling Guide

For Organisms Used in STC/MS™ Unit:
Organisms: From Macro to Micro

Amoeba
Cabbage White Butterfly
Daphnia
Elodea
Euglena
Hydra
Lemna
Lubriculus
Paramecium
Spirogyra
Volvox
WOWBug™

Introduction

Using live organisms during classroom instruction, especially with inquiry-based science curricula such as STC/MS™, can greatly enhance and extend student learning. Children have an opportunity to observe, handle, and care for organisms that they probably have never seen or touched before. These first-hand experiences are exciting for youngsters and can translate into improved learning outcomes.

With the use of living organisms in the classroom may come additional instructional concerns and responsibilities for you the teacher. Most organisms have specific habitat requirements such as type of shelter, food and water sources, and temperature range. If these needs aren't met, your organisms will sicken and even die prematurely, which of course will diminish students' learning opportunities. That's why Carolina Biological Supply Company has created this document—to help ensure your use of living materials in the classroom is a successful experience. The care and handling information provided here is similar to or the same as the instructions shipped with your live organisms. If you are using the live organisms as part of a hands-on science kit, these instructions are meant only to supplement, not replace, any directions that may be included in the unit's teacher's guide.

Explanation of Level

Each living organism in this document has been assigned a difficulty level of **Easy**, **Moderate**, or **Advanced**. Admittedly, we have used varying criteria to determine each rating. If your intent were to keep the organisms in your classroom for a few days only, then the level of difficulty would change to **Easy**. By way of contrast, the cabbage white butterfly (brassica butterfly), when used with the STC/MS™ hands-on science unit Organisms—From Macro to Micro, must be kept alive for an extended length of time in order for students to complete the unit activities. This rates it an **Advanced**.

Technical Support and Questions

We hope your experience using Carolina's live materials is trouble-free. However, if you encounter any problems, please contact us. Direct your living materials question (8 am–5 pm ET, M–F) to Tim Woody (800.227.1150, ext. 4381, timothy.woody@carolina.com)

Orders and Replacements

To place an order or request a replacement, contact Carolina at 800.334.5551 (8 am–8 pm ET, M–F), then select Customer Service. If requesting a replacement, please have your order number available.

ADVISORY ON RELEASING OR DISPOSING OF ORGANISMS

The National Science Resources Center advises against the release of any organisms used in the STC/MS™ program. In some documented cases, environmental problems have resulted from the introduction of nonindigenous organisms into nature. It is also illegal in many states to release organisms, even indigenous species, without a permit. (The cultured organisms may carry genes that could affect the wild population.) The intention of these laws is protection of native wildlife and the environment.

The organisms used in the STC/MS™ units were thoroughly researched before they were selected. Other than the cabbage white caterpillars, the organisms are unlikely to harm local ecosystems. Nevertheless, allowing their release into nature might encourage your students to release other organisms that could cause harm to native wildlife and local ecosystems. If you have any questions about releasing organisms in your area, contact your state or local environmental conservation agency.

After you complete the unit, there are several things you can do with the organisms (except for the cabbage white butterfly):

- Continue to maintain them in your classroom.
- Donate them to a pet shop, zoo, or nature center.
- Donate them to another classroom or to another school's science department.
- With parental permission, let your students take them home for use in personal aquariums, etc.

As a last resort, biologists suggest that you place the organisms in a sealed container, freeze them overnight, and dispose of them according to your school district's policy on organic waste material disposal.

If you give the organisms to students or to other groups, please make them aware of the advisory on releasing organisms.

For the cabbage white butterfly:

Cabbage white butterfly: Because disposal of cabbage white caterpillars is regulated by the U.S. Department of Agriculture (see the special note on pages 81–82 in your *Organisms—From Macro to Micro Teacher's Guide*), disposal of the organisms must be controlled. Your 2 disposal options are:

- Wait until the butterflies die naturally. (The adult life span of the butterfly is short, about 2 weeks.) Consider saving the dead adult butterflies in a plastic cup with holes punched in the lid. They are ideal specimens to examine through the microscope.
- Humanely euthanize the eggs, larvae, and adult butterflies by placing them a sealed container in a freezer for 48 hours.

Amoeba

(*Amoeba proteus*)

Uses: Study the characteristics of microorganisms, diversity of microorganisms, cell structure and function, cell movement

Level: Moderate

Special requirements: Spring water or filtered pond water*

The body of an Amoeba and other protozoans consists of a single cell, but it is a mistake to think of these organisms as "simple." Without benefit of multicellular tissues or organs, many protozoa achieve structural complexity that rivals that of some multicellular animals. For this reason, some biologists prefer to think of protozoan organization as "acellular" rather than "unicellular." Amoebae are found in freshwater locations like ponds and streams, typically on decaying vegetation.

Care and handling of cultures: IMMEDIATELY UPON RECEIPT, OPEN THE SHIPPING CONTAINER AND REMOVE THE CULTURE JAR. Carefully open the jar and aerate the culture using the pipette supplied (use only new or biologically clean pipettes). To aerate the culture, place the tip of the pipette in the upper layer of liquid in the culture jar and gently press the pipette bulb. This will blow air bubbles into the liquid. Remove the pipette tip from the liquid and allow the pipette to refill with air, then blow more air bubbles into the liquid. Do this several times.

Allow 15 to 20 minutes after aeration for the animals to settle, and then inspect the contents using a microscope at low light level. If you receive more than one culture in your shipment, use a different pipette for each culture, and write the name of the organism on the pipette to avoid cross-contamination. Warn students against contaminating or accidentally killing a culture. Students should use the provided pipettes.

Never place the culture in a refrigerator or in direct sunlight. It should be kept cool (20° to 22° C, 68° to 72° F) with the lid placed lightly over the jar. Some protozoan cultures react noticeably to environmental changes. If the temperature suddenly drops, Amoebae become sluggish. Animals that are actively feeding or undergoing mitosis tend to ball up. This does not mean they are dead or dying; dead protozoans disintegrate, leaving no visible remains. The organisms may arrive partially covered with metabolic debris, but this is also normal. Careful examination of the cultures using a microscope should reassure you that they are still healthy. In an undisturbed culture, most Amoebae will settle to the bottom of the container, where they can be seen with a stereomicroscope.

Using a stereomicroscope and a clean pipette, you can easily pick up a single specimen (or group of specimens) for a slide. If a stereomicroscope is not available, very carefully draw into a pipette a small amount of material from the bottom of the jar. One drop should contain more than enough organisms for one good slide mount. Follow any other instructions in your Teacher's Guide.

We provide all protozoan cultures with an ample food source, some of which may not have been consumed. This is not contamination. After several weeks, however, all food may have been consumed. If you wish to feed your Amoebae, place 3 or 4 grains of previously boiled wheat seed in the culture jar. Add spring water or pond water as needed. The water in the culture should not become clouded. Each week draw off and discard about 1/4 of the culture water and replace it with new spring water.

*If you keep your protozoan culture long enough, water will evaporate out of the culture jar and will need to be replaced. Tap water is not suitable, so use spring water or filtered pond water. We do not recommend using the "spring water" available at most grocery or drug stores; it may contain trace

amounts of metal ions that can kill the protozoans. The best source of replacement water is pond water that has been filtered (poured through cheesecloth), or boiled and allowed to cool to room temperature.

FAQs

Q. We haven't been able to find any Amoebae. Where are they?

A. *Because they are small, colorless, slow moving, and do not have a fixed shape, Amoebae can be difficult to find. Allow the culture jar to remain undisturbed for 15 to 20 minutes. Most of the Amoebae will settle to the bottom and begin to crawl about. Place the culture jar on the stage of a stereomicroscope at 20 to 40x and focus on the inside bottom of the jar. You may have to watch for several seconds, but you should begin to see Amoebae as they slowly move about. Once you see one, it will be easier to find others.*

Q. Are these Amoebae dangerous?

A. *No. There are parasitic Amoebae that can cause illness, but these Amoebae are free-living and harmless.*

Cabbage white butterfly

(Pieris rapae)

Uses: Study of insect characteristics, life cycles, plant-animal relationships

Level: Advanced

Special requirements: Brassica plants and sugar-water solution

Cabbage white butterflies follow the typical butterfly life cycle: egg, larva (caterpillar), pupa (chrysalis), and adult. Cabbage whites inhabit Europe, northwest Africa and Asia; they have been introduced to North America and Australia, where they are a serious pest of crops.

Care and handling of cultures: IMMEDIATELY UPON RECEIPT, OPEN THE SHIPPING CONTAINER AND INSPECT THE STRIP OF EGGS. The eggs, upon arrival, should hatch 48–72 hours after they are placed on plant material. Prior to the eggs' arrival, you should have sown at least 10 radish or brassica plants (per unit of eggs) on which to start your larvae. The cabbage white butterfly is especially fond of Wisconsin Fast Plants®, available from Carolina Biological Supply Company. When placing the eggs on the leaves of potted plants, cut the egg strip into 4 to 6 smaller sections and place each section, eggs facing down, on a separate leaf. Immediately after a larva chews its way out of the egg, it may begin to feed on adjacent eggs on the strip. For that reason, enough extra eggs are included in each unit to ensure the 5 or 6 successful hatches expected.

Important: If you neglected to prepare radish or brassica seedlings on which to hatch the eggs, you need to get some cabbage leaves right away. If possible, use organically grown produce, free of pesticides. To remove possible pesticide residue from grocery store produce and ensure the health of the larvae, be sure to remove the outer leaves and discard. Rinse the inner leaves thoroughly with cool water and pat dry with a clean paper towel. Tear off a few leaves and place them in 3 or 4 plastic containers, such as 12-oz deli cups. Cut your egg strip into smaller pieces and place each piece, eggs facing down, on one or more cabbage leaves. The larvae develop more slowly and are more difficult to see on the cabbage leaves than on potted plants. Allow 5 or 6 days before expecting to see the larvae.

Note: Cabbage white butterfly larvae are extremely small and translucent in color when they first hatch, so they are difficult to see. If you think your eggs have not hatched and there are no larvae, please do the following before calling Carolina for a replacement. Look for signs of something chewing on your plants and/or for frass (larvae excrement). The larvae are usually found on the underside of the leaf. Using a small hand magnifier may be helpful.

The tiny larvae crawl off the egg strip and immediately feed on the plant material. Larvae molt 2 to 3 times in the first week. When molting, larvae seek a dry site, weave a fine carpet of silk, attach to it, lie quietly, then crack and crawl out of their exoskeleton and quickly pump up their new exoskeleton before it rigidifies.

The larvae's excrement, frass, dries to fine, dark-black granules, which may be used as fertilizer for additional plants. When using cabbage leaves, you will need to carefully remove the cabbage and larvae from the dish occasionally to clean out the frass. Otherwise, the larvae's frass might encourage the growth of mold on the food plants. Also, remove any old, dry leaves and replace them with fresh ones whenever needed.

Once the larvae you placed on potted plants have eaten them down, you can gently remove the larvae and either place them on more plants you have prepared, or place them on any available brassicas, such as cabbage, brussels sprouts, or broccoli. These should be set up in plastic containers. Be sure to remove the outer leaves of the brassica to eliminate any pesticide residue. Use a brush to remove the larvae;

they should not be physically handled prior to the fourth instar (approximately 12–15 days old) because they are tiny and can be easily injured.

After 18–20 days, the larvae will begin to prepare to pupate. Transition from larva to adult occurs during the pupal stage within the chrysalis and is known as metamorphosis. When preparing for pupal formation, a larva will weave a strong carpet of silk on the plant or container. (Larvae have silk glands in both the anterior and posterior ends.) The larva then weaves a silk belt around its middle and attaches its rear end to the carpet. The exoskeleton of the pupa is initially soft. Allow the exoskeleton to harden for several hours, and then gently remove the pupa from its attachment site and use double-stick tape to attach it to a piece of paper. Hang the paper inside your butterfly box or cage. Approximately 6–7 days after pupa formation, a butterfly should emerge. Newly emerged butterflies will hang quietly to allow their wings to expand and harden. Wings usually take 15 minutes to expand, then another several hours to harden.

The butterflies should be kept at room temperature (22° to 24° C, 72° to 76° F). If you want them to mate and lay eggs, provide them with a light in or near their cage for 18 hours a day. If you are just keeping the butterflies to observe and enjoy, normal room lighting is sufficient.

Sugar, water, minerals, and other nutrients found in floral nectar are the primary food source of adult cabbage white butterflies. Water and energy from sugar are essential. Without them, adult butterflies die in a few days.

The mouthparts of adult butterflies function solely to take in water and dissolved nutrients. The butterfly proboscis is an elongated feeding tube that can be rolled up or extended through the use of specialized muscles. The length of the extended proboscis varies greatly from species to species, depending on the particular flowers the butterflies are adapted to feed on.

If you have planted Wisconsin Fast Plants for your butterflies and they are flowering, the butterflies will quickly forage for nectar from the flowers. If the flowers are not open or are past flowering, or if you did not use Wisconsin Fast Plants, then an artificial feeder can be made according to the following directions:

Obtain an empty plastic film canister. Clean it with a mild solution of household bleach (5%) in water and then rinse it **thoroughly**. Fill it with warm water. Add 1 teaspoon of sugar, 2–3 drops of honey, and 2 drops of yellow food coloring. Stir well. Punch a hole in the lid of the canister, large enough to easily insert a couple of white felt wicks. The wicks should be approximately 1/4 inch wide by 2 inches long. Dip the felt pieces into the sugar-water solution and then squeeze out the excess water. Insert the felt into the hole in the lid, leaving approximately 3/4 inch extending out the top of the lid. Place the lid on the canister. Fold the protruding wicks over toward the opposite sides of the canister, so the wicks create the 2 “petals” of a flower. The sugar/water solution should be replaced every other day. With proper nutrition, the adult butterflies generally live for 1 or 2 weeks, sometimes as long as 3 weeks.

Follow all other care and handling instructions in your Teacher’s Guide.

FAQs

Q. What are brassica plants?

A. Brassicas are members of a large family of flowering plants, many of which are grown for food. Examples include radish, turnip, cabbage, kale, mustard, collards, broccoli, and cauliflower.

Q. I see butterflies in my garden that look like the cabbage white butterfly. Is this possible?

A. Yes. The cabbage white butterfly is found throughout much of North America. It belongs to a family of butterflies that are white, yellow, or orange in color.

Q. The eggs hatched but the larvae died. What caused this?

A. *They may have starved. Newly hatched larvae cannot chew through tough plant material as well as older larvae can. Try to start them on young, tender leaves. The humidity also may have been too low. Due to their small size, the larvae can dehydrate rather quickly. If you think humidity is a problem, mist the larvae a few times a day. Use a very fine spray of dechlorinated, room-temperature water. These two problems can be related, since the larvae get moisture from the food they eat. If they are able to feed properly, humidity will seldom be a problem.*

Daphnia

(*Daphnia pulex*)

Uses: Study of structure and function, behavior, consumers in aquatic habitats, pulsation of heart

Level: Advanced

Special requirements: Spring water or filtered pond water*

The *Daphnia* genus is a common small crustacean of freshwater ponds and lakes. *Daphnia* swim with their antennae and feed with their legs. They are characterized by a “jerky” method of movement, which occurs because the large antennae are used as oars, causing the body to jump forward as the antennae snap backwards. This “jumping” movement gives *Daphnia* the common name of “water flea.” A filter feeder, the thoracic legs act as sieves for filtering algae, bacteria, and small particles of debris from the water. Food is transferred to the mouth where it is ground by the mandibles and moved through the gut for digestion. A *Daphnia* is highly transparent—a stereomicroscope allows you to see its heart beat.

Care and handling of cultures: IMMEDIATELY UPON RECEIPT, OPEN THE SHIPPING CONTAINER AND INSPECT YOUR SHIPMENT. Remove the lid from the shipping jar and allow the lid to just sit on top of the jar. DO NOT AERATE THE CULTURE WITH A PIPETTE OR ANY OTHER DEVICE. Keep the jar in a cool area (21° C, 69° F) out of direct sunlight.

Daphnia feed on algae and are sometimes used to clear up “green water” in an aquarium. They also feed on bacteria and yeast. Prepare as follows a yeast suspension as food for *Daphnia*. You can use a rinsed 2-liter soft drink bottle and spring water. Stir in enough baker’s yeast to make the water milky, and store the suspension in a refrigerator. Always agitate the water before use to resuspend the yeast, using a few drops each day. An alternative is to crush 3 to 4 grains of dry baker’s yeast on clean paper and dust this on the surface of the culture. Avoid overfeeding. Hard-boiled egg yolk or powdered egg yolk can be used in the same amounts as yeast to encourage the growth of bacteria. However, if bacteria overgrow, they can kill the animals.

The water in the culture should not become clouded. Each week draw off and discard about 1/4 of the culture water and replace it with new spring water. Do not use city tap water or distilled water because *Daphnia* are extremely sensitive to metal ions, which are usually present in at least trace amounts. In fact, *Daphnia* are so sensitive to contaminants that they are used to monitor the water quality of streams and lakes.

Follow any additional instructions in your Teacher’s Guide.

*If you keep your *Daphnia* culture long enough, water will evaporate out of the culture jar and will need to be replaced. Tap water is not suitable, so use spring water or filtered pond water. We do not recommend using the “spring water” available at most grocery or drug stores; it may contain trace amounts of metal ions that can kill the *Daphnia*. The best source of replacement water is pond water that has been poured through cheesecloth, or boiled and allowed to cool to room temperature.

FAQs

Q. I poured my *Daphnia* culture into an aquarium, and they all floated. What went wrong?

A. *Daphnia* have an expanded carapace, a part of the exoskeleton that encloses the sides of the thorax and abdomen, with a space between the carapace and the body. When you poured the *daphnia*, air became trapped in this space, causing them to float to the surface where they were trapped. Never aerate *daphnia* or put an air stone in an aquarium or holding tank that contains them. Add *daphnia* to an aquarium by gently submerging the open jar and “pouring” them underwater.

Q. How can I tell male from female Daphnia?

A. *During breeding season, this is easy. Female daphnia have a dark egg sac inside the carapace and on the back.*

Q. Can I keep daphnia in an aquarium with fish?

A. *The fish will eat them. In fact, many aquarium hobbyists culture daphnia to feed their fish.*

Q. Can I refrigerate daphnia?

A. *We do not recommend refrigeration of these organisms. Plan on using the culture as soon as possible after its arrival.*

Elodea

(Elodea densa, Elodea canadensis [also known as Egeria densa and Anacharis densa])

Uses: Study of the characteristics of plants, characteristics of aquatic plants, producers in aquatic food webs and chains

Level: Easy

Special requirements: Aquarium

Restrictions: Elodea densa (catalog no. 16-2101, 16-2102, and 16-2103) cannot be shipped into SC, WA, or ME. Customers in these restricted states will be shipped Elodea canadensis. Canadian orders require a permit from the Canadian government.

Elodea (Egeria, Anacharis) is a common aquarium plants. It can flower and produce seeds, although they more commonly reproduce asexually by stem fragmentation. Plants may root or float free in the water. The most common species are native to the Americas, but they have been introduced worldwide. Elodea (Egeria) densa (commonly called Brazilian Elodea), the most common of all aquarium plants, sometimes becomes invasive in streams, lakes, and ponds, so it should not be released into local waterways. Some states restrict shipments of Elodea densa. Carolina Biological Supply Company ships Elodea canadensis, which is native to North America, to those states.

Acclimation of plants: Elodea is shipped in bundles that are secured with rubber bands and wrapped in wet newspaper. Remove the newspaper and cut the rubber bands. Either rinse the plants in running tap water or swish them about in a pail of aged tap water. This is to clean the plants, so discard the rinse water after you finish. Inspect the plants and discard any that appear unhealthy. Also discard any unwanted snails or other animals that may have hitched a ride on the plants. Place the plants in a holding tank of aged, conditioned tap water until you are ready to use them in class. Don't keep them in the holding tanks too long. If they must be kept for more than one day, replace some of the water (not more than 1/4 of it) with fresh, aged, conditioned water. Also turn the plants over so that any that were covered by others will be exposed to light. The plants need bright light for best growth.

FAQs

Q. Why aren't the plants growing?

A. It can take some time for the plants to adjust to a new home. Fish and other animals in the aquarium release waste products into the water that serve as nutrients for the plants. In a new aquarium, it may take time for these to accumulate, so be patient.

Q. Will the plants form roots?

A. They may or may not. Elodea often floats free in the water. In an aquarium, it is able to absorb nutrients directly from the water, so roots aren't necessary. If it does form roots, it will probably take some time for them to grow

Q. Will the fish and snails eat the plants?

A. They may. After all, plants are producers and animals are consumers. If growing conditions are good for the plants, both they and the animals flourish.

Q. Why are my plants dying?

A. There can be many reasons for this. Are the plants getting enough light? Are the aquaria being disturbed too often? The plants must be allowed to "settle in" to grow well. Some nutrient could be missing from the water. A lack of phosphorus and iron may limit the growth of water plants. If possible, add a small amount of water-soluble fertilizer that contains these nutrients. If your water is treated with a water softener (unlikely), that may cause aquarium plants to grow poorly.

Euglena

(*Euglena gracilis*)

Uses: Study the characteristics of microorganisms, diversity of microorganisms, cell movement

Level: Easy

Special requirements: Spring water or filtered pond water*

Euglena exhibits characteristics of both plants and animals. Like a plant, Euglena contains chlorophyll, allowing it to make its own food through photosynthesis. When light is not available and it cannot photosynthesize, Euglena resembles other animals—it gains nutrients by absorbing them across its cell membrane.

Euglenae use a whiplike flagellum to move about in a spiral path. You can find this protozoan in a variety of aquatic habitats, both freshwater and marine.

Care and handling of cultures: IMMEDIATELY UPON RECEIPT, OPEN THE SHIPPING CONTAINER, REMOVE THE CULTURE JARS, AND INSPECT THEM. Once you have verified that the shipment is OK, loosen the lids on the jars. Aerate the cultures using the pipettes supplied. To aerate, place the tip of a pipette into the culture water and squeeze the bulb, bubbling air into the water. Withdraw the pipette and release the bulb, allowing it to refill with air. Repeat about 4 times. This replaces oxygen, which may have been depleted during shipment.

Allow 15 to 20 minutes after aeration for the animals to settle, and then inspect the contents using a microscope at low light level. If you receive more than one culture in your shipment, use a different pipette for each culture, and write the name of the organism on the pipette to avoid cross-contamination. Warn students against contaminating or accidentally killing a culture. Students should use the provided pipettes.

Never place the culture in a refrigerator or in direct sunlight. Euglenae do best in a well-lighted area (artificial light), but out of direct sunlight because high temperatures are harmful. The culture should be kept cool (20° to 22° C, 68° to 72° F) with the lid placed lightly over the jar.

Some protozoan cultures react noticeably to environmental changes. Animals that are actively feeding or undergoing mitosis tend to ball up. Do not be alarmed, for they are not dead or dying; dead protozoans disintegrate, leaving no visible remains. The organisms may arrive partially covered with metabolic debris, but this is also normal. Careful examination of the cultures using a microscope should reassure you that they are still healthy.

Using a stereomicroscope and a clean pipette, you can easily pick up a single specimen (or group of specimens) for a slide. If a stereomicroscope is not available, very carefully draw into a pipette a small amount of material from the bottom of the jar. One drop should contain more than enough organisms for one good slide mount. Follow any other instructions in your Teacher's Guide.

If Euglenae are kept in bright light, they will make their own food, eliminating the need for additional feeding by the teacher. The water in the culture should not become clouded. Each week draw off and discard about 1/4 of the culture water and replace it with new spring water.

*If you keep your protozoan culture long enough, water will evaporate out of the culture jar and will need to be replaced. Tap water is not suitable, so use spring water or filtered pond water. We do not recommend using the "spring water" available at most grocery or drug stores; it may contain trace

amounts of metal ions that can kill the protozoans. The best source of replacement water is pond water that has been filtered (poured through cheesecloth), or boiled and allowed to cool to room temperature.

FAQs

Q. Are Euglenae protists or algae?

A. Protists are one-celled (or acellular) organisms with nuclei, so Euglena qualifies as a protist. Since it is capable of photosynthesis, it is also an alga. To complicate matters, there are Euglenae that do not have chloroplasts and are not photosynthetic.

Q. How long can I keep my cultures before using them?

A. If possible, use them within 2 to 3 days of receipt. The longer you delay, the more likely the cultures will go bad, be knocked over, etc.

Q. Will the cultures last longer if I place the jars in a refrigerator?

A. We don't recommend refrigeration or rapid temperature changes. Refrigeration may kill the organisms.

Q. My students aren't finding any Euglenae. What can I do?

A. Euglenae are a bit smaller than other protists commonly studied. If your students have previously observed Paramecia, they may need to look for something smaller. Let them observe on low power for several seconds. They can use the fine adjustment of the microscope to focus on different levels within the slide. They need to find slowly moving dots or "wiggles." Once they see one of these, they should center it in the field of vision and switch to a higher power. They may need to refocus slightly using the fine adjustment.

Hydra

(*Hydra sp.*)

Uses: Study of structure and function, behavior, consumers in aquatic habitats, regeneration

Level: Moderate

Special requirements: Spring water

Hydras are freshwater organisms with a tube-like body. A single opening, the mouth, leads into a gastrovascular cavity. The mouth is surrounded by tentacles armed with stinging cells. When a prey organism, such as a small crustacean, brushes against the Hydra's tentacles, the Hydra first harpoons it with stinging nematocyst threads; it then uses its tentacles to guide the meal into its mouth.

Hydras that live on the undersides of lily pads and other leaves in cool ponds and streams look like tiny pieces of frayed string. Hydras can move from place to place by "walking" or somersaulting on their tentacles or by sliding along in measuring-worm style.

Sometimes called the "eternal animal," Hydra has an amazing ability to regenerate lost body parts. A Hydra cut in half will form 2 complete animals within a few days.

Care and handling of cultures: IMMEDIATELY UPON RECEIPT, OPEN THE SHIPPING CONTAINER AND INSPECT YOUR SHIPMENT. Leave the lid off the jar for about 30 minutes. If you are not going to use the culture immediately, set the lid loosely on top of the jar, to let air in but keep dust out. Keep the culture in dim light, at a temperature of about 70° F (21° C). The Hydra can live for about a week in the water in the culture jar. If you plan to keep the organisms longer than this, siphon off about 1/3 of the old culture water each day and replace it with fresh spring water.

To feed the Hydra, follow the directions provided in your Teacher's Guide.

FAQs

Q. Our Hydra appear sick. What's wrong with them?

A. *During the sexual phase of their life cycle, Hydra put most of their energies into producing sperm and eggs. They contract and appear "sick." This more often happens during the spring season.*

Q. Our Hydra were doing well, then they all disappeared. What happened?

A. *It is difficult to maintain a small culture of Hydra for more than a few days. Also, Hydra are delicate animals, easily damaged when moved onto a slide for observation. There really isn't much you can do. Plan on using the Hydra as quickly as possible after receipt.*

Lemna (duckweed)

(Lemna minor)

Uses: Study of the characteristics of plants, characteristics of aquatic plants, producers in aquatic food webs and chains

Level: Easy

Special requirements: Aquarium

Duckweed (*Lemna minor*) flourishes in a variety of environments and can be found in clear water as well as dark, brackish water. This small, floating plant often covers the surface of a pond.

Acclimation of plants: Simply add the plants to a holding tank of aged, conditioned tap water. Maintain the plants at temperatures between 18° to 25° C (65° and 77° F) for best results. There are no special light requirements.

Follow any additional instructions in your Teacher's Guide for each of these plants.

FAQs**Q. Why aren't the plants growing?**

A. It can take some time for the plants to adjust to a new home. Fish and other animals in the aquarium release waste products into the water that serve as nutrients for the plants. In a new aquarium, it may take time for these to accumulate, so be patient.

Q. Will the plants form roots?

A. Duckweed often forms short roots that help absorb nutrients from the water.

Q. Will the fish and snails eat the plants?

A. They may. After all, plants are producers and animals are consumers. If growing conditions are good for the plants, both they and the animals flourish.

Q. Why are my plants dying?

A. There can be many reasons for this. Are the plants getting enough light? Are the aquaria being disturbed too often? The plants must be allowed to "settle in" to grow well. Some nutrient could be missing from the water. A lack of phosphorus and iron may limit the growth of water plants. If possible, add a small amount of water-soluble fertilizer that contains these nutrients. If your water is treated with a water softener (unlikely), that may cause aquarium plants to grow poorly.

Lumbriculus (California blackworm)

(Lumbriculus variegatus)

Uses: Study of the characteristics of soft-bodied invertebrates, behavior, regeneration, pulsation of blood vessels

Level: Easy

Special requirements: Spring water or aged tap water

Lumbriculus resemble miniature earthworms and live in the sediment and silt of freshwater ponds and lakes. A transparent body reveals many of the organism's internal organs.

Care and handling of cultures: IMMEDIATELY UPON RECEIPT, OPEN THE SHIPPING CONTAINER AND INSPECT YOUR SHIPMENT. To maintain your culture of Lumbriculus, you will need a deep pan or dish, spring water (or aged tap water), a plastic pipette, brown paper towel, and sinking fish food. Fill the pan with 2–3 inches of spring water. Transfer the worms into the water with a plastic pipette. Do not handle or transfer worms with forceps or hooks; they are easily injured by these instruments. Add strips of folded brown paper towel to the pan, covering the bottom. This will serve as a substrate of decomposing material for the worms and for numerous microscopic organisms that may inhabit the culture, such as bacteria, rotifers, and ostracods. Folding the paper towel allows Lumbriculus to “hide” inside the folds and avoid light, because they prefer darkness. Lumbriculus will break down quickly (disintegrate) if they are not kept cool. An ideal temperature is about 15° C (60° F). A slightly warmer range (18° to 21° C, 65° to 70° F) is acceptable, but requires that the culture water be changed more frequently—about every 2 to 3 days. Temperatures above 21° C (70° F) will cause organism disintegration.

The sinking fish food is the main food source for the worms. Add 1 or 2 pellets. After a few days, 1 or 2 more pellets can be added if the original pellets have been consumed. Do not overfeed; decomposing food can contaminate the culture, causing a mass die-off of worms. Irregular feedings or weeks of starving will not harm the worms.

Gentle aeration is recommended but not required. To aerate the culture, place the tip of the pipette in the upper layer of liquid in the culture container and gently press the pipette bulb. This will blow air bubbles into the liquid. Remove the pipette tip from the liquid and allow the pipette to refill with air, then blow more air bubbles into the liquid. Do this several times.

Water lost to evaporation is simply replaced by adding spring water. The culture water should be replaced every 2–3 weeks as the paper towel disintegrates and waste residues accumulate. Decant the culture slowly, being careful not to pour out the paper and worms that remain at the bottom. After rinsing the paper and the worms with spring water, refill the pan to the original level and add new pieces of towel. Occasional “harvesting” of surplus worms is advised (for classroom experiments, live fish food, or starting duplicate cultures), and maintenance of at least one duplicate culture is strongly suggested. Under these conditions, worms will reproduce asexually and cultures can be sustained for years. For additional preparation directions, follow the instructions detailed in Lesson 2 of the Teacher's Guide.

FAQs

Q. Will the blackworms reproduce?

A. *In a culture, blackworms reproduce readily by asexual fragmentation and regeneration. If you are referring to sexual reproduction, this is very unlikely to occur in culture, although it is common in natural populations.*

Q. Do blackworms have eyes?

A. *No, but they do have sensory cells that can detect shadows. They may rapidly contract when a shadow passes over. This may help them escape from predators. They are also sensitive to pressure changes and vibrations.*

Paramecium

(Paramecium multimicronucleatum)

Uses: Study the characteristics of microorganisms, diversity of microorganisms, cell structure and function, cell movement, consumers in aquatic food webs and chains

Level: Easy

Special requirements: Spring water*

Paramecium is a small unicellular organism found in freshwater ponds. It swims, rotating slowly, and often changing its direction. To help it move in water, Paramecium possesses short, hair-like cilia that beat in unison.

Care and handling of cultures: IMMEDIATELY UPON RECEIPT, OPEN THE SHIPPING CONTAINER, REMOVE THE CULTURE JARS, AND INSPECT THEM. Once you have verified that the shipment is OK, loosen the lids on the jars. Aerate the cultures using the pipettes supplied. To aerate, place the tip of a pipette into the culture water and squeeze the bulb, bubbling air into the water. Withdraw the pipette and release the bulb, allowing it to refill with air. Repeat about 4 times. This replaces oxygen, which may have been depleted during shipment.

Allow 15 to 20 minutes after aeration for the animals to settle, and then inspect the contents using a microscope at low light level. If you receive more than one culture in your shipment, use a different pipette for each culture, and write the name of the organism on the pipette to avoid cross-contamination. Warn students against contaminating or accidentally killing a culture. Students should use the provided pipettes.

Never place the culture in a refrigerator or in direct sunlight. It should be kept cool (20° to 22° C, 68° to 72° F) with the lid placed lightly over the jar. Some protozoan cultures react noticeably to environmental changes. Animals that are actively feeding or undergoing mitosis tend to ball up. This does not mean they are dead or dying; dead protozoans disintegrate, leaving no visible remains. The organisms may arrive partially covered with metabolic debris, but this is also normal. Careful examination of the cultures using a microscope should reassure you that they are still healthy.

Using a stereomicroscope and a clean pipette, you can easily pick up a single specimen (or group of specimens) for a slide. If a stereomicroscope is not available, very carefully draw into a pipette a small amount of material from the perimeter of the jar. One drop should contain more than enough organisms for one good slide mount. Follow any other instructions in your Teacher's Guide.

We provide all protozoan cultures with an ample food source, some of which may not have been consumed. This is not contamination. After several weeks, however, all food may have been consumed. If you wish to feed your Paramecia, place 6 to 8 grains of previously boiled wheat seed in the culture jar. Add spring water or pond water as needed. The water in the culture should not become clouded. Each week draw off and discard about 1/4 of the culture water and replace it with new spring water.

*If you keep your protozoan culture long enough, water will evaporate out of the culture jar and will need to be replaced. Tap water is not suitable, so use spring water or filtered pond water. We do not recommend using the "spring water" available at most grocery or drug stores; it may contain trace amounts of metal ions that can kill the protozoans. The best source of replacement water is pond water that has been filtered (poured through cheesecloth), or boiled and allowed to cool to room temperature.

FAQs

Q. How long can I keep my cultures before using them?

A. If possible, use them within 2 to 3 days of receipt. The longer you delay, the more likely the cultures will go bad, be knocked over, etc.

Q. Will the cultures last longer if I place the jars in a refrigerator?

A. We don't recommend refrigeration or rapid temperature changes. Refrigeration may kill the organisms.

Q. Can I make my cultures last longer?

A. Paramecium is easy to culture. You can find instructions in the Carolina Protozoa and Invertebrates Manual. This would make a good project for your students.

Q. My students aren't finding any Paramecia. What can I do?

A. The culture may have been agitated, scattering the Paramecia. Look at the culture after it has sat undisturbed for at least 15 minutes. You should see some debris and fuzzy material near the bottom of the jar. Bacteria, which the Paramecia feed on, are found in the fuzzy material. Paramecia concentrate in this area to feed. To sample this area, squeeze the bulb of a pipette and insert the tip vertically into the culture. When the tip is just above or actually in the fuzzy material, release the bulb. Lift the pipette vertically out of the culture. As long as you do not bubble air into the culture, squirt the water back into the culture, or use the pipette to stir the culture, the Paramecia remain concentrated and easy to sample.

Spirogyra

(Spirogyra grevilleana)

Uses: Study the characteristics of microorganisms, producers in aquatic food webs and chains

Level: Easy

Special requirements: Spring water or filtered pond water*

Spirogyra is a freshwater green alga, shaped in chains of hair-like filaments. The green color indicates the presence of chlorophyll, which can be seen as spiral bands within the organism. Chlorophyll enables Spirogyra to make its own food through photosynthesis.

Care and handling of cultures: IMMEDIATELY UPON RECEIPT, OPEN THE SHIPPING CONTAINER AND INSPECT YOUR SHIPMENT. Once you have verified that the shipment is OK, loosen the lid on the jar. These organisms need light but not heat. However, most freshwater algae can tolerate a range of temperatures—from 15° to 25° C (60° to 77° F). Indirect natural light is good, but not direct sunlight. Fluorescent light, either cool white or full spectrum, is good. Avoid incandescent lamps, as they can overheat the water and kill your algae. Plan to use your algae as soon after receipt as possible.

*If you keep your algal culture long enough, water will evaporate out of the culture jar and will need to be replaced. Tap water is not suitable, so use spring water or filtered pond water. We do not recommend using the “spring water” available at most grocery or drug stores; it may contain trace amounts of metal ions that can kill the algae. The best source of replacement water is pond water that has been poured through cheesecloth, or boiled and allowed to cool to room temperature.

FAQs

Q. How long can I keep my Spirogyra culture before use?

A. *Algae, including Spirogyra, are shipped to be in prime condition when you receive them. The sooner you use them, the better. At most, plan to keep algae cultures no longer than 2 to 3 days before using them.*

Q. Will the Spirogyra culture last longer if I place the jars in a refrigerator?

A. *We don't recommend refrigeration or rapid temperature changes.*

Q. What should I do with the Spirogyra culture after we have finished using it?

A. *Why not set up a spare 5- to 20-gallon aquarium in a well-lighted area? Add any leftover aquatic organisms to the aquarium and see what happens. Which organisms survive? What are some possible reasons that an organism does or does not survive?*

Volvox

(*Volvox globator*)

Uses: Study the characteristics of microorganisms, producers in aquatic food webs and chains

Level: Easy

Special requirements: Spring water or filtered pond water*

Volvox is a member of the green algae group; that is, it has the same photosynthetic pigments (chlorophyll) found in green plants. Algae is a catchall word that includes organisms that live in water (mostly) and that use the energy of sunlight to manufacture sugars, i.e., the process of photosynthesis. This makes algae important producers in many aquatic and marine habitats. Indeed, algae have been called "the grass of many waters." Algae are grouped according to the types of photosynthetic pigments they produce. Thus, there are blue-green, red, and brown algae.

Care and handling of cultures: IMMEDIATELY UPON RECEIPT, OPEN THE SHIPPING CONTAINER, REMOVE THE JAR OF VOLVOX AND INSPECT IT. You should be able to see tiny green dots in the water, although a magnifier may be needed for this. Sometimes the best way to see Volvox is to remove the lid from the jar and look down from the top. Once you have verified that the shipment is OK, loosen the lid on the jar. These organisms need light but not heat. In fact, a cool room temperature is better for them. Indirect natural light is good, but not direct sunlight. Fluorescent light, either cool white or full spectrum, is good. Avoid incandescent lamps, as they can overheat the water and kill your algae. Plan to use your algae as soon after receipt as possible.

*If you keep your algal culture long enough, water will evaporate out of the culture jar and will need to be replaced. Tap water is not suitable, so use spring water or filtered pond water. We do not recommend using the "spring water" available at most grocery or drug stores; it may contain trace amounts of metal ions that can kill the algae. The best source of replacement water is pond water that has been poured through cheesecloth, or boiled and allowed to cool to room temperature.

FAQs

Q. Can I keep the Volvox culture longer if I pour off and replace some of the water in the jar?

A. *Probably not. Again, use the material as soon as possible.*

Q. My students aren't finding any Volvox. What can I do?

A. *Try positioning a lamp or flashlight next to the jar so that the light shines through the jar. The Volvox colonies should now show up as brightly lit dots. Gently squeeze a pipette bulb and lower the pipette until its mouth is near one of the dots. Release the bulb and the Volvox should be pulled into the pipette. Transfer the Volvox to a deep-well slide.*

WOWBug™
(*Melittobia digitata*)

Uses: Example of a parasite, study of behavior

Level: Moderate

Special requirements: None

WOWBugs are small, harmless, parasitic wasps unable to sting humans. Found around the globe, they are easy to handle, and no expensive equipment is needed to study them. All stages of the life cycle are readily visible: their eggs are attached to the outside of the host insect's body, and their pupae are naked, lacking any cocoon to cover them. The pupae of the WOWBugs are cream-colored and approximately 1/8 inch long. A prolific reproduction rate helps make WOWBugs ideal for classroom use.

Care and handling of cultures: IMMEDIATELY UPON RECEIPT, OPEN THE SHIPPING CONTAINER AND INSPECT YOUR SHIPMENT. Your culture of WOWBugs was shipped while the insects were in the pupal stage. Some adults may have emerged while in transit. If the majority of the WOWBugs are still in the pupal stage, simply wait several days and adults will emerge. There is no need to feed the adult WOWBugs.

Maintain the WOWBugs at room temperature. At normal room temperatures of 22° to 30° C (72° to 86° F), the entire WOWBug life cycle (egg, larva, pupa, adult) takes 18–25 days. While in the pupal stage, the WOWBug does not move around or eat. WOWBugs have never been observed feeding during the adult stage, although some evidence suggests that males cannibalize one another, and it is possible that females may feed on juices from their host organism.

For long-term storage, cultures are best refrigerated when WOWBugs are in the prepupal stage (fully fed larvae). This most closely mimics the stage at which they spend the winter outdoors. Should it be absolutely necessary to refrigerate adults, keep them cold for as short a time as possible, and store them in the butter compartment on the refrigerator door where the temperature is slightly warmer. Don't be alarmed if they don't move right away when you take them out. It sometimes takes up to an hour for them to warm up enough to begin to behave normally.

FAQs

Q. What are the dark, pill-like things that I received?

A. *These are puparia, cases that enclose fly pupae. WOWBug larvae are parasites of fly pupae. After the WOWBug larvae grow to full size, they stop feeding and become pupae themselves. They emerge as tiny adult wasps. The adult wasps should begin emerging about the time you receive your shipment.*

Q. Will adult flies emerge from the puparia?

A. *This is possible but unlikely. The fly pupae have been so heavily parasitized by WOWBug larvae that they probably will be unable to emerge. If they do, they can be killed by freezing.*